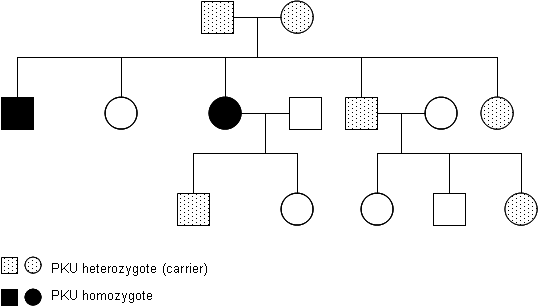
/12 KU /16 TI **Genetics Quest**

1. Which of the following about Mendel is true?
   1. Mendel’s experiments proved that Blending Theory was correct
   2. The offspring of two purebred P generation lines led to a 3:1 ratio of dominant to recessive traits in the F1 generation
   3. Mendel was the first person to discover sex-linked inheritance
   4. **Mendel’s Law of Segregation states that for each characteristic, an organism has two copies of a gene, one from each parent**
   5. Mendel’s Law of Independent Assortment states that the inheritance of one gene affects the inheritance of other genes.
2. John has blue eyes (bb) which is a recessive trait. What are possible genotypes of his parents?
   * 1. BB and bb
     2. BB and Bb
     3. Bb and Bb
     4. Bb and bb
     5. bb and bb
3. I, IV, V
4. II, III, IV
5. **III, IV, V**
6. I, II, III, IV, V
7. V
8. Which of the following statements are true?
   1. Dominant alleles are always more common than recessive alleles
   2. All genes can have only one dominant allele.
   3. If you are a carrier of a recessive allele, you must be homozygous.
   4. **T.H. Morgan showed that white eyes on fruit flies is a sex-linked trait**
   5. None of the above are true
9. Which of the following is true?
   1. In DNA, Chargaff’s rule states that A always bonds G, and C always bonds T.
   2. **Rosalind Franklin used X-ray crystallography to prove the structure of DNA.**
   3. The normal human karyotype has 48 chromosomes. 23 pairs of autosomes and 2 sex chromosomes.
   4. Watson and Crick treated Rosalind Franklin very well because they thought highly of female scientists at the time.
   5. None of the above are true.
10. Farah took a true-breeding smooth pear tree and crossed it with a true-breeding rough pear tree. She got seven rough skinned pear trees as a result. What does this say about the trees?
    1. The parental pear trees were both heterozygous
    2. The offspring pear trees were all homozygous
    3. **‘Rough skinned’ is a dominant trait for pears.**
    4. If she bred the offspring pear trees with each other, she would likely get a 3:1 ratio of smooth to rough pear trees.
    5. The genotypes here are ‘rough’ and ‘smooth’ pears.
11. A dog breeder crossed two lines of huskies. One is purebred for white fur and blue eyes (WWbb). One is purebred for grey fur and brown eyes (wwBB). They yield and F1 generation of WwBb huskies. The breeder then mates two of these dogs (WwBb x WwBb) to make an F2 generation. Which best describes the phenotypic ratio of the F2 generation?
    1. **There will be a 9 White Brown : 3 White Blue : 3 Grey Brown: 1 Grey Blue ratio**
    2. There will be a 3 White Blue : 1 Grey Brown ratio
    3. There will be a 3 Grey : 1 White ratio, regardless of eye colour
    4. There will be a 9 White : 3 Grey : 3 Brown : 1 Blue ratio
    5. There will be a 1 White Brown : 1 White Blue : 1 Grey Brown: 1 Grey Blue ratio
12. When a true breeding round radish is crossed to a true breeding long radish, they produce oval radishes. What would be the phenotypic ratios of a cross between two oval radishes?
    1. 2 Oval : 2 Round
    2. 9 Oval : 3 Round : 3 Long : 1 Round-long
    3. 3 Round : 1 Long
    4. **1 Round : 2 Oval : 1 Long**
    5. 1 Oval : 2 Round : 1 Long
13. A paternity test is being done to determine who fathered a young child. The mother, Wilma Flintstone has type B blood. The child is shown to have type AB blood. Who is the father?
    1. **Peter Griffin – Type A**
    2. Homer Simpson – Type B
    3. Stan Smith – Type O
    4. All of the Above
    5. None of the above
14. Colour in snapdragons is inherited according to the principle of incomplete dominance. When a red and a yellow snapdragon are mated, what are the expected phenotypic frequencies of their offspring?
    1. ¼ Red , ½ Red and Yellow mix, ¼ Yellow
    2. 100% Red and Yellow mix
    3. ¼ Red , ½ Orange, ¼ Yellow
    4. **100% Orange**
    5. ¾ Red , ¼ Yellow
15. When a white cat and a black cat are mated, they create a calico cat (one with black and white patches). This best represents:
    1. Complete dominance
    2. Incomplete dominance
    3. **Codominance**
    4. Half dominance
    5. sex-linked inheritance
16. Which statements about an X-linked gene are true?
    * 1. **If a man has a diseased allele, he will be affected (express the phenotype).**
      2. **The man will pass this allele down to all of his daughters**
      3. All of the sons of an affected man will be affected.
      4. If a woman is a carrier, all of her sons will be affected.
      5. **If a woman is a carrier, approximately half her daughters will be affected.**
17. I, II, IV
18. **I, II, V**
19. II, IV, V
20. II, IV
21. I, II, III, IV, V
22. What mode of inheritance is represented by the following pedigree?

(Note that grey is a carrier, and black is affected)

* 1. Autosomal Dominant
  2. **Autosomal Recessive**
  3. Sex-Linked Dominant
  4. Sex-Linked Recessive
  5. Holandric (Y-linked)

1. The trait for long tail (L) in rats is dominant to that of short tail (l). The trait for red eyes (R) is dominant to that of black eyes (r). A black eyed, heterozygous for long tail rat is mated to a red-eyed, long tail rat, heterozygous for both traits.

Show a full Punnett Square analysis. (2)

1. What are the phenotypic ratios of the possible offspring? (1)

Parents rrLl x RrLl (1 Mark)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | rL | rL | rl | rl |
| RL | RrLL | RrLL | RrLl | RrLl |
| Rl | RrLl | RrLl | Rrll | Rrll |
| rL | rrLL | rrLL | rrLl | rrLl |
| rl | rrLl | rrLl | rrll | rrll |

(1 Mark)

Freq

Red Long 6/16

Red short 2/16

Black Long 6/16

Black Short 2/16

Ratio: 3 Red Long : 1 Red Short : 3 Black Long : 1 Black Short (1 Marks)

1. What are the odds that the two rats will produce a black eyed, short tail rat? (1)

The odds are 1/16 that the two rats will produce a black eyed short tail rat (1 mark)

1. Harry and Ginny have two children, James, who has type O blood, and Lily, who has type AB blood. Both of Ginny’s parents had type A blood.
   1. What is the probability that Harry and Ginny’s next child, Albus, will have type A blood? Show with a Punnett Square (3)

Harry is IBi Ginny is IAi (1 mark)

|  |  |  |
| --- | --- | --- |
|  | IB | i |
| IA | IAIB | IAi |
| i | IBi | ii |

Freq AB = 25% A = 25% B = 25% O = 25% (1 mark)

Albus has a ¼ chance of having type A blood (1 mark)

1. From who in the family could the newest child, Albus**, receive** blood? (0.5)

Albus could receive blood from Ginny or James (.5 mark)

1. To who in the family could Albus **give** blood? (0.5)

Albus could give blood to Ginny or Lily (0.5 mark)

1. Wing length in flies is inherited according to the principle of X-linked inheritance. Short wings are recessive to long wings. Two long wing flies were mated together and produced a generation of 50% long-winged carrier female, 25% short-winged male, 25% long winged male.
   1. Show the phenotypic ratio of the offspring of a mating between a long winged carrier female and a short winged male (2)

Cross 1 XLXl x XlY

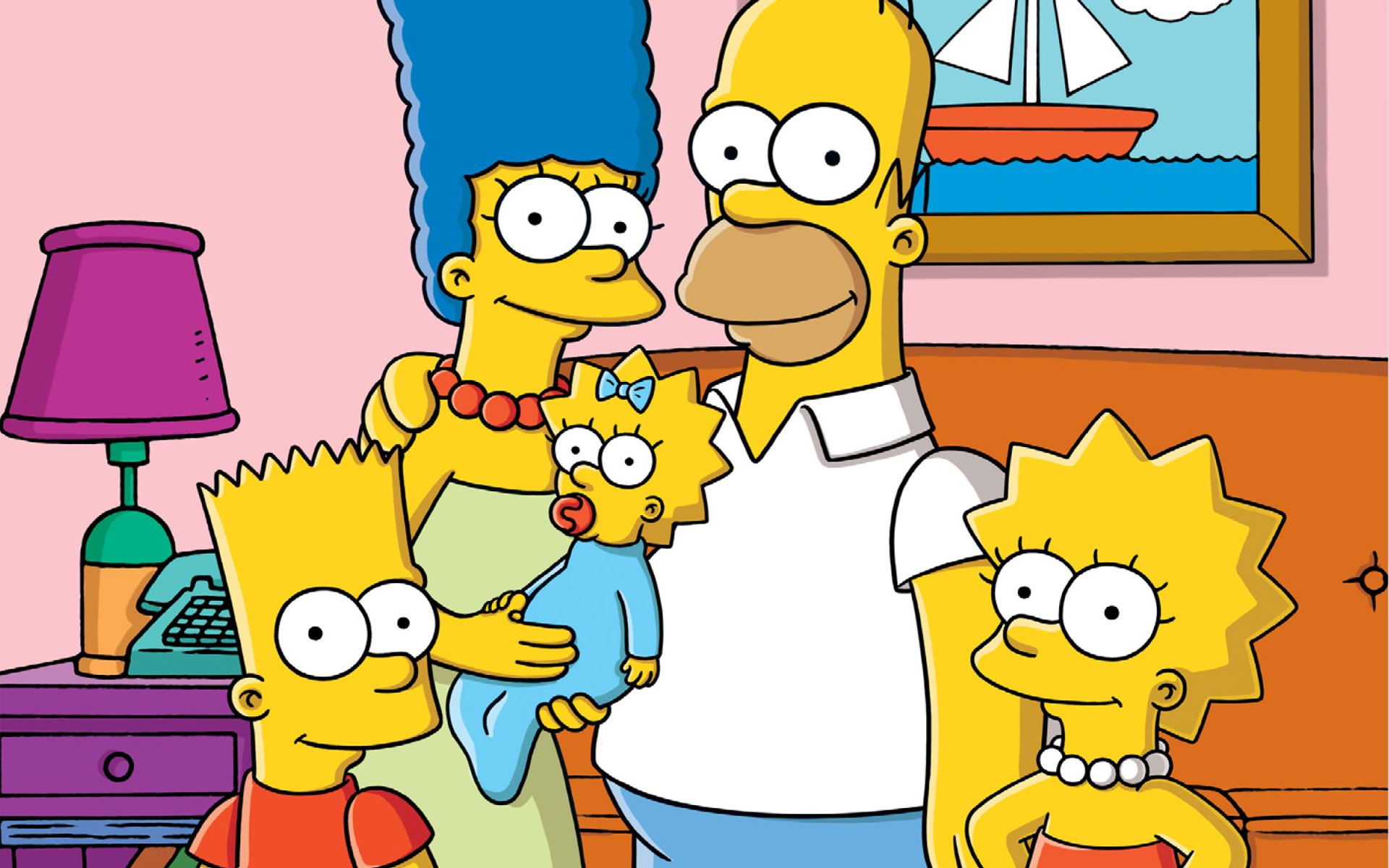
|  |  |  |
| --- | --- | --- |
|  | Xl | Y |
| XL | XLXl | XLY |
| Xl | XlXl | XlY |

1 carrier female : 1 normal male : 1 short wing female : 1 short wing male (1 for chart, 1 for ratio)

* 1. What percentage of **male flies** will have short wings? (1)

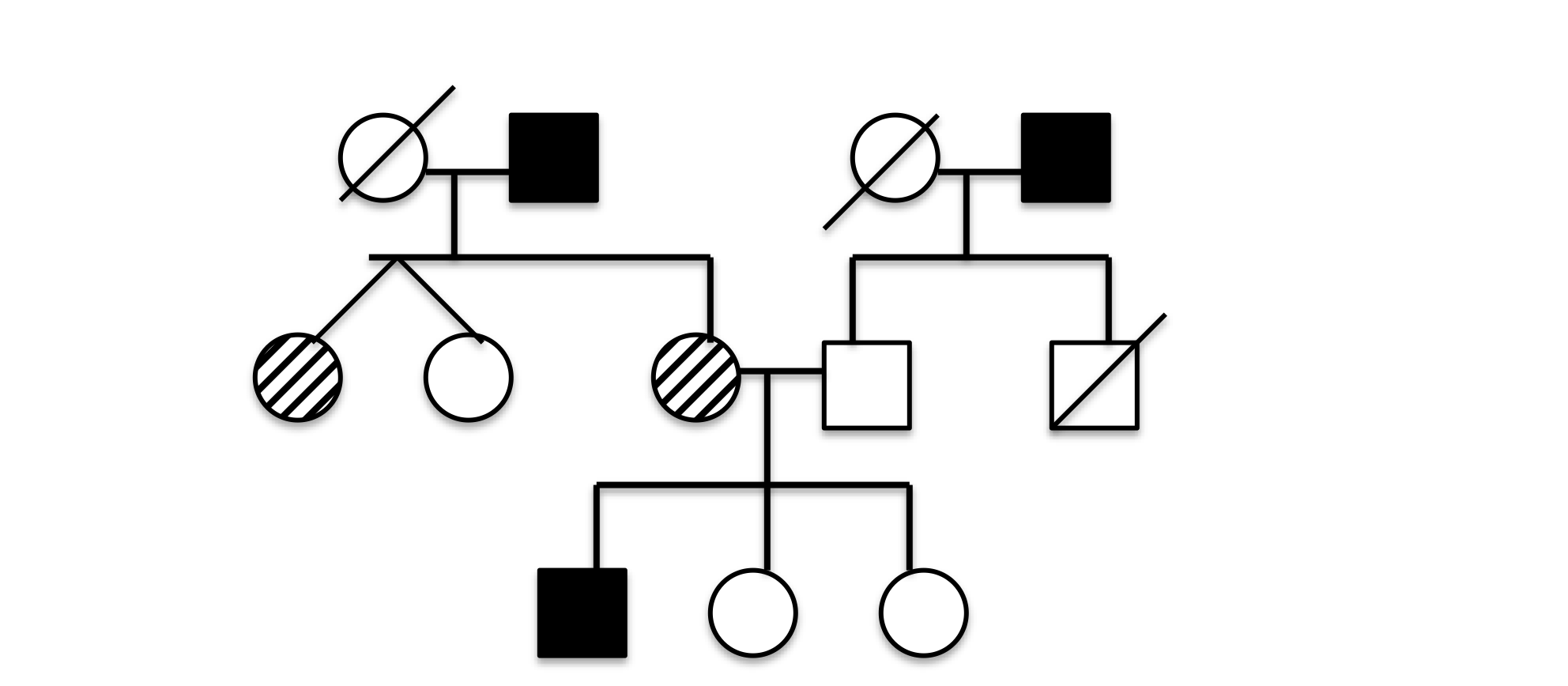
50% of male flies will have short wings

1. The Simpsons family is consulting you, their cartoon geneticist, for help! Normally Springfield residents have four toes but there is a hereditary mutation that leads them to having five toes.

* Marge carries the extra toe gene. She is married to Homer. They have three children, Bart, Lisa, and Maggie, born in that order.
* Bart has five toes…which is one more than normal, when you are a cartoon character.
* Marge has two older sisters, Patti and Selma, who are non-identical twins. Marge’s mother passed away. Her father, also deceased (dead) was known to have an extra toe. Patti had a genetic test done, and it turns out that she is a carrier for the extra toe gene. Selma refused the test.
* Homer’s parents are Mona (deceased) and Abe Simpson. Homer has a long lost younger brother, Herb, who died in a car crash. Homer does not have an extra toe, but Abe does.

a) Draw a pedigree of the Simpson family, from the above information, tracing the pattern of inheritance of the extra toe.

(/3)



Marking Scheme

2 Points – correctly setting up the diagram itself (correct people in the correct place with the correct lineage

1 Point – correctly indicating affected, carrier, and deceased persons

b) What pattern of inheritance does the extra-toe mutation follow? (/1) \_\_\_X-linked Recessive\_\_\_

c) What is Bart’s genotype? (Use T,t, XT,Xt,Y as necessary) (/1)\_\_\_\_\_\_\_\_\_\_XtY\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_